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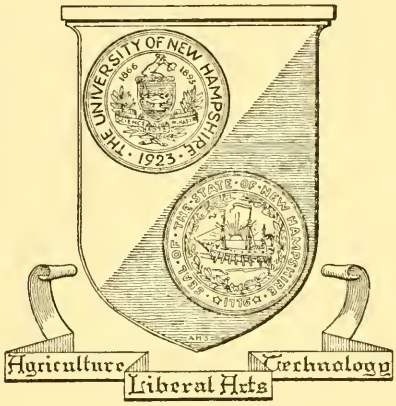

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Bulletin No. 287 August 1935

Twenty-Five Years of Research

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NEW HAMPSHIRE
AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEW HAMPSHIRE
Durham, New Hampshire

TWENTY-FIVE YEARS OF AGRICULTURAL RESEARCH

Director J. C. Kendall

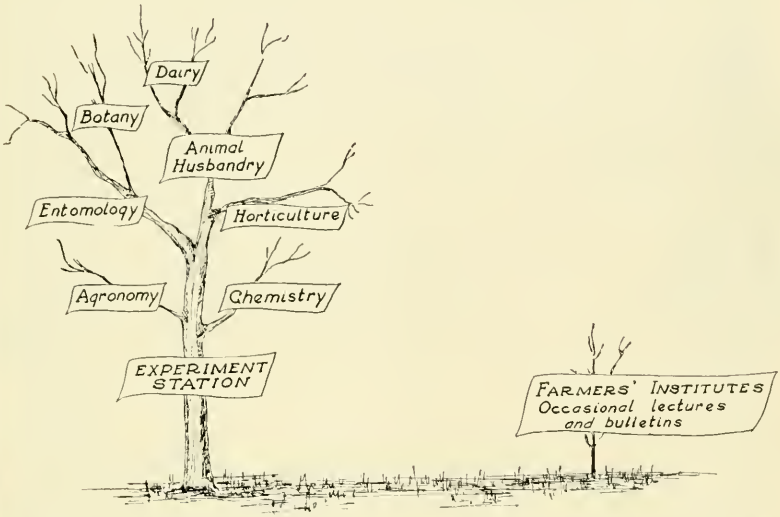
FOR the past quarter century the New Hampshire Agricultural Experiment Station has been under a continuous directorship. From the vantage point of these twenty-five years this bulletin is an attempt to survey something of the developments of the institution, and of its significance in the state.

In 1910 the Experiment Station had already been operating for 23 years. During this period the institution was finding its place as the official testing ground for the state's agriculture; much of our knowledge of climatic and soil adaptations was gained then. The battle for fertilizer and feeding-stuff inspections was fought and won. The extent of insect infestation and of plant diseases was partially mapped. Members of the staff had won considerable confidence among the farmers of the state, and a new attitude toward scientific practices was evident.

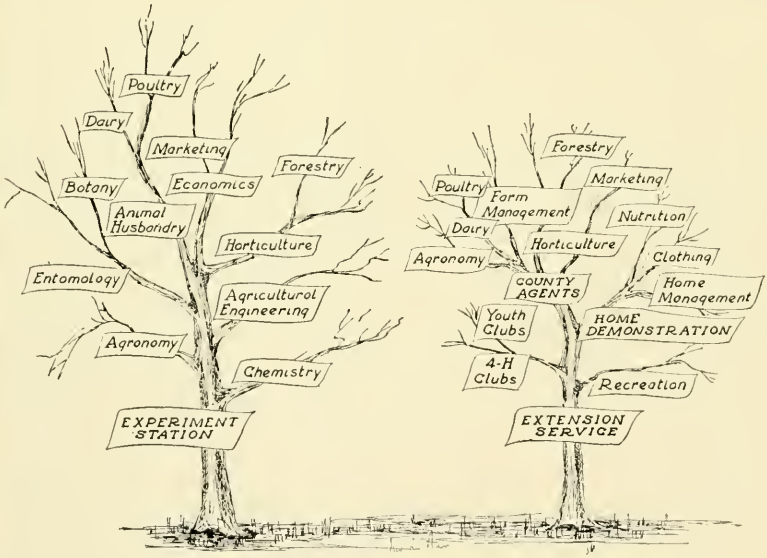
A new epoch started in 1911, however, when the Board of Trustees officially inaugurated extension work, placing it in charge of J. C. Kendall who had been made director of the station the previous year. While the two divisions are kept distinct, there has been the closest possible interplay between research and extension agencies and the quick spread of extension organization throughout the state is in no small degree a result.

The scientist must explore with infinite patience, accurately, impartially, must be willing to turn back and try again and again. Only a limited number of projects, therefore, can be conducted at any one time. The New Hampshire Station has attempted to take its share of these problems, keeping its eye on the most pressing needs of the state and also on the fundamental questions of agricultural science. It is possible within these pages only to suggest some of the major developments.

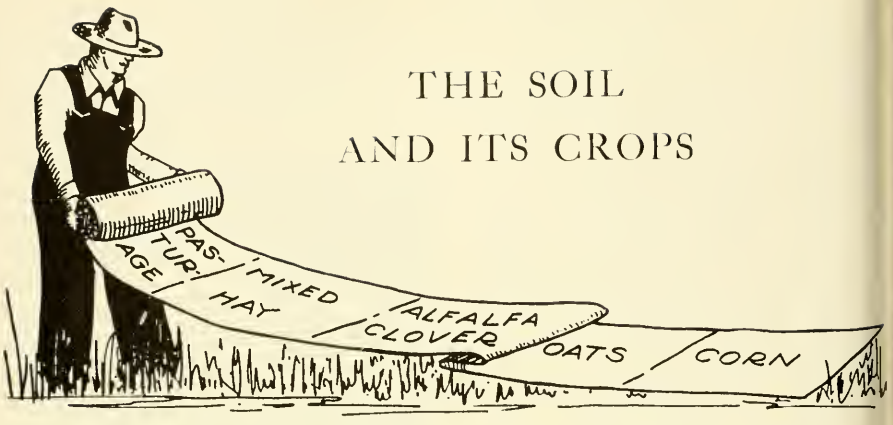
A STORY OF TWO TREES



In 1910 seven main lines of agricultural research had been developed. Extension work was limited to occasional lectures, farmers' institutes



In 1935 twelve branches of research work are maintained
Extension service has been developed with specialists in eleven subjects, reaching rural men, women and young people in every county and practically every community in the state



THE SOIL AND ITS CROPS

ACCURATE knowledge of the soil and its adaptation to different crops is fundamental to New Hampshire's agricultural development. The Station conducts experimental fields in five representative sections of the state, involving 56 acres and nearly a thousand plots. A detailed soil survey of the entire tillage area of the state is under way. All this work is accompanied by chemical tests. Improvements in technique now make it possible to give fairly definite recommendations as to soil management. Tests are for acidity, calcium, magnesium, potassium, manganese, aluminum, phosphorus and nitrate and ammonium nitrogen.

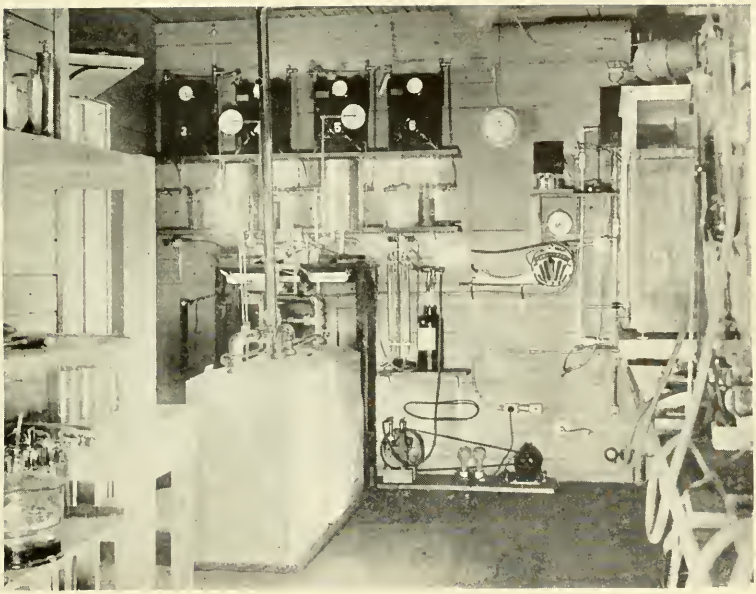
Tackling the all-important problem of efficient feed production for the state's $10,000,000 dairy industry, the Station has conducted:

1. *Detailed investigations of alfalfa and sweet clover.* Soil, fertilizer and lime requirements are now quite definitely known.

2. *Studies of the time of cutting grass hay.* Proof that digestible protein per acre is 50 per cent greater when grass hay is cut before the period of bloom (June 20) has revolutionized the haying period in the state. On thousands of farms which formerly waited until July 4 to start haying, the mowing machine goes into operation two weeks earlier.

3. *Top-dressing experiments.* It has been found that grass hay carefully fertilized has higher protein and feeding value.

4. *Pasture studies.* The state's pasture acreage is being profoundly influenced by the revelations of the experimental plots. On some of the better areas it was found that two to eleven times as much feed could be produced in the pasture with fertilizer as the same amount of money would buy at the feed store.



These appliances, measuring the metabolism of animals on the other side of the partition, told laboratory technicians the exact difference in feeding value of early and late cut hay. This sensitive apparatus measures, to one part in a hundred thousand, the volume of air and the percentage of its oxygen and carbon dioxide after it is drawn out of the air-tight chamber

Results of the research on early cut hay, explained by the county agents to farmers, have put forward the state's haying clock by two weeks

The Laboratory for Animal Nutrition Studies at Durham

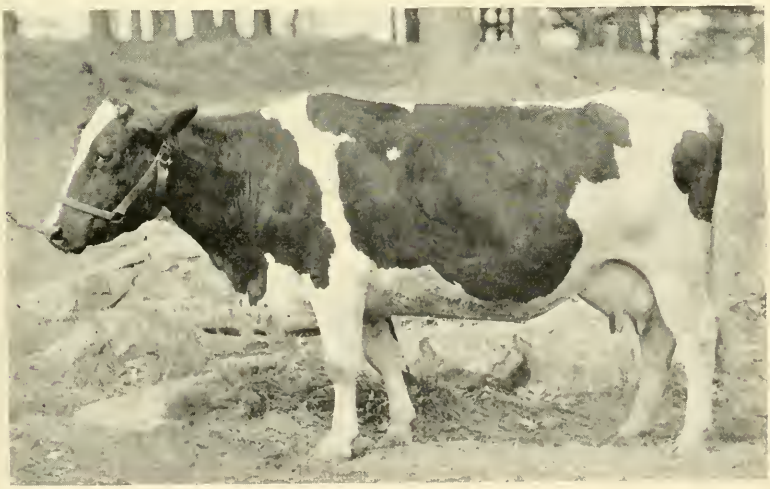
MEASURING ANIMAL DIGESTION

TO THIS inexpensive laboratory at Durham have come within the last few years scientists from fifteen foreign countries, as well as many from the other states of the Union. They are attracted by the special technique evolved here for measuring the digestibility of feeds and the metabolism of different farm animals.

In 1918 Dr. F. G. Benedict, Director of the Carnegie Institution's Nutrition Laboratory and internationally famous for research work in human nutrition, selected the New Hampshire Station for the cooperative development of a new and simplified type of animal nutrition laboratory. Here, as a result, have been conducted studies of the comparative basal metabolism of beef cattle, horses, sheep, goats, pigs, and dairy cows. By means of the ingenious respiration chamber investigators have been able to follow, day by day, changes in weight and general condition to measure loss of weight through lungs and skin because of insensible perspiration; to determine physical and chemical changes in excreta; to observe and record the effect upon heart-rate, respiration-rate, and internal and external temperature; to compute the total heat produced by the animals during 24-hour periods; and to ascertain what energy yielding material was being burned by the animals to supply this heat. In addition, accurate daily records were obtained on all these points when modified by changes in quantity and kind of food and by the position of the animals, as when standing or lying down.

IT IS not surprising to learn that the animal above is a less efficient milk producer than the one below. The amazing thing is that, although weighing nearly 300 lbs. less, she eats sixteen per cent more food.

The basal metabolism of both cows was measured when they were dry. The upper cow consumed 7290 calories, the lower, 6270. Facts like these are throwing new light on the fundamentals of animal nutrition.



THE PROGRAM BEHIND APPLES

GOOD apples no longer grow of their own accord.

New Hampshire's rocky hillsides have always put superior color and flavor into the fruit; but at the turn of the century few growers were prepared to face the competition of cultivated orchards and the battle with disease and insect pests.

Research at the New Hampshire Station has changed all that. Perhaps the most important contribution was the establishment of the fact that nitrates are lacking under sod. From this discovery grew the present sod-mulch system.

Point by point the details of a definite program for efficient orchard management have been worked out:

Nitrate applications. Under our soil conditions it has been indicated that in most instances growers need not spend money for fertilizer elements other than nitrogen. The annual saving is conservatively figured at 10 cents per tree; on the 350,000 trees in the commercial orchards of the state, this means $35,000.

Efficiency spray program. The facts as to scab, apple maggot, and other pests have been determined, and a workable control program evolved. Emphasis on adequate equipment such as the three-four or six-nozzle brooms has cut the labor requirement for spraying more than 35 per cent.

Pollination. The discovery that the triploid pollen of Baldwin is unsuitable for McIntosh has saved many growers from serious mistakes

Storage. A special technique for handling McIntosh to improve its keeping qualities has been developed, adding several months to the season.

As a result of this and other research new life has been put into the state's orchard industry. Instead of tapering off, commercial production has doubled since 1910. In 1933 it reached a peak of 850,000 bu hels.

If no adequate substitute for cultivation had been found, most New Hampshire orchards would have been hopelessly handicapped. Under the sod-mulch system, land like this grows efficiently the apples for which the state is becoming famous

The nitrate ring — a key point in the sod-mulch program

WHY POTATOES ARE COMING BACK

POTATOES, which were a declining industry in New Hampshire, have shown a decided recovery. From 100 bushels per acre in 1919, the state yield has climbed steadily up to a record of 171 bushels per acre in 1934. In 1934 the crop amounted to 1,750,000 bushels, the high point of the last twenty years. The come-back is due primarily to research. Fundamental to the program have been investigations as follows:

Certified seed. Average increases of over 60 bushels per acre from the use of certified stock were proved by experimental tests in every county of the state.

Spraying. Details of a control program for late blight including mixtures, pressures and time of application have been carefully worked out, and now form the basis of the commercial practices in the state.

Meanwhile fertilizer requirements have been carefully determined in a series of different experiments. Methods of planting have been perfected. Up-to-date plans for storage have been drawn.

Economic studies have shown the deficient areas, and have formed the basis for a comprehensive state marketing program.

Heavy pressure behind the spray has proved an important factor in control of late blight

(ABOVE) *Behind the right mixture in the spray tank lie years of patient, careful research into varying combinations*

(CENTER) *The row in the center was planted with weak sprouting tubers. Experiments like this formed the foundation for certified seed*

(BELOW) *Weak sprouting seed and the short stubby sprouts recommended*

Feeding time on the pullet range of one of New Ho ps

THE POULTRY IN

NEW HAMPSHIRE took the aggressive in the poultry business about 1920. Within the next ten years the industry practically doubled. Annual production of eggs and chickens increased from $4,000,000 to $8,000,000.

From the start the storm-center of the movement has been the Experiment Station; and the slogan has been "Quality Stock." The New Hampshire Red has become famous.

The drive against pullorum disease was started in 1918. At that time not more than 60,000 baby chicks were produced for sale in the state. About 4,000 birds were tested the first year. Today flocks, comprising 239,000 birds, or one fifth of the state's chickens are under

A tray of chicks from an accredited "Red" farm, which started with a batch of 100 chicks in 1916. In 1935 the owner sold 400,000 and had orders for more

ultry farms. This plant accommodates 13,000 birds

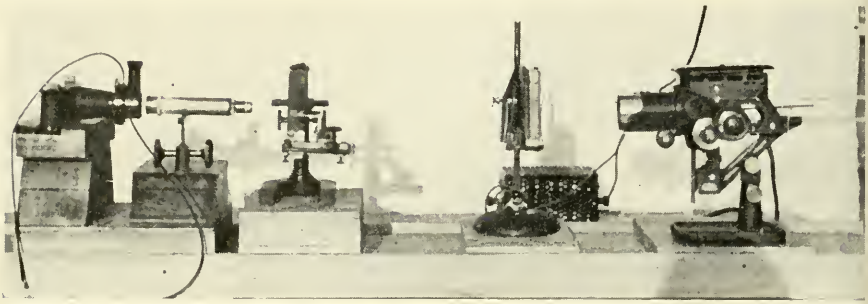
HIFTS INTO HIGH

test. The total annual hatch from the 178 accredited flocks is estimated at 6,000,000 chicks, and New Hampshire's disease-free stock is greater than in any other state in the Union.

Further progress in breeding has been conducted through certification and Record of Performance work, and in disease prevention through vaccination campaigns against fowl pox and infectious laryngotracheitis and through zealous investigation of other troubles. The poultry laboratory, running about 2000 autopsies a year, has become the first line of defense against disease.

Meanwhile other research has been conducted in feeding, housing and economic problems.

Vaccinating a bird to prevent fowl pox. Vacine is handled in a specially prepared building under government regulation



Apparatus used for photographing drops of spray material in the study of contact insecticides. More than 10,000 photomicrographs have been made

TRIBUTE collected by insect pests in New Hampshire alone is estimated at about $1,000,000 a year. Against this insect enemy the Station's entomology department is the headquarters for attack. It studies the life history of pests under New Hampshire conditions, and perfects the control measures. In such wise during the past twenty-five years it has conducted detailed studies that throw valuable light on:

Apple maggot	The European corn borer
Black flies	The stalk borer
Root maggots	The white pine weevil
Termites	Arsenical residues

Meanwhile, more than local significance attaches to much of the research work of the laboratory. Requests for information on the New Hampshire investigations come from all over the civilized world.

These codling moth eggs were prevented from hatching by the application of ovicides. This mode of attack, which is being carefully studied by New Hampshire's entomologists, may revolutionize insect control measures

One of the toughest resisters to scientific warfare has been the squash bug. Even he is yielding to new sprays developed in the Station's study of contact insecticides

Particular interest has focussed during recent years on the sequence of studies of contact insecticides. Because of increased governmental restrictions on fruits and vegetables sprayed with arsenicals, there has been need for more accurate information regarding oils and other types of spray materials. A new technique for determining the effectiveness of such insecticides has been worked out, and was recently termed by a famous English toxicologist one of the most fundamental contributions to the subject yet made. Ten different bulletins dealing with various phases of the study have already been published. Now the attack is being carried forward into the field of insect eggs.

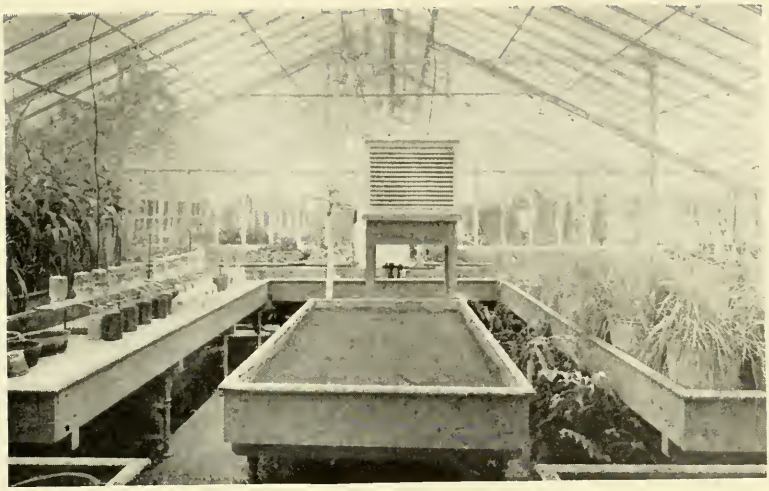
Complete studies of the apple maggot, running over many years, have established significant facts about this distinctive pest, including the discovery that it is able to hold over in the ground for two years

ONE APPLE IN EVERY SEVEN

ONE apple in every seven, one potato in every twelve is said to be destroyed annually by plant disease. In the country as a whole the loss amounted to 14,000,000 bushels of apples and 98,000,000 bushels of potatoes in 1927. In the world-wide fight of science against these diseases, the New Hampshire Station has contributed new knowledge regarding such important sprays as the sulphur fungicides, Bordeaux and Burgundy mixtures.

ONE POTATO IN EVERY TWELVE

Worlds of technique lie behind the manufacture, combination and mixing of potato dusts



Experiments are conducted under controlled conditions in the greenhouses, and then put to the acid test of field plots

One of the outstanding results of the vegetable experiments has been the discovery of the effect of phosphoric acid upon the maturity of tomatoes. The fruit matures ten days or two weeks earlier where phosphorus is applied

ECONOMICS COMES TO THE FORE

WITHIN the last decade has come the highly important development of economic research, already involving 22 different projects in dairying, horticulture, poultry, potatoes, vegetables and general marketing. Significant results include:

1. A picture of the economic balance between production and consumption of local farm products. This has served as a base for determining state policies. The state potato marketing campaign, which has brought home grown stock into deficit areas, is an outgrowth.

2. Fruit farm studies, which showed that the labor used in New Hampshire orchards varied from .9 to 3.6 hours per mature tree. The necessity of more efficient spray management was clearly shown, and the results set in motion a campaign which is correcting the situation. Inefficiency of filler trees on cheap land was also indicated.

3. Potato production studies, which have greatly affected prevailing ideas to the size of economic units.

Areas as small as 3.8 acres proved large enough to handle economically machinery for potato production

4. Feed store costs, which showed that New Hampshire farmers were paying as high as sixty per cent for credit.

5. Poultry studies, which enabled extension workers to interpret the effect of changing egg, fowl, broiler and feed prices.

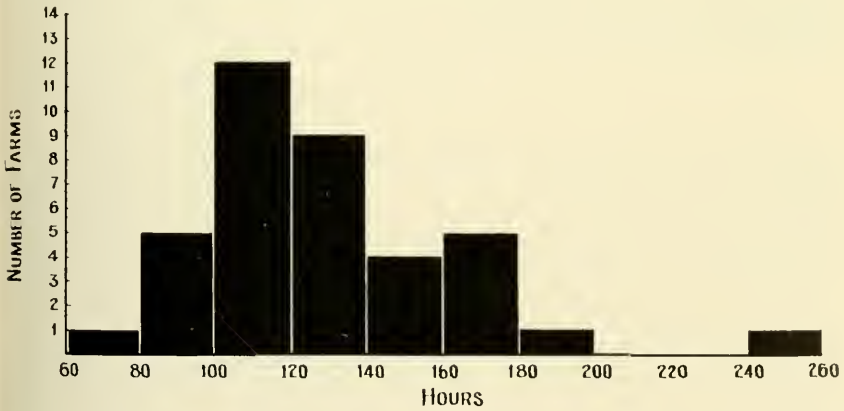
6. A roadside marketing survey, which showed the needs and extent of this business in the state.

7. Hay and silage production studies, which resulted in the recommendation of a definite cropping program for the dairy farms of the state.

8. Milk farm studies, which showed a rather complete economic picture of wholesale milk production in the Connecticut Valley. Widely varying requirements in barn operations were found, indicating that certain farmers could save over two hours a day by rearranging their barns and reorganizing their methods. A study of Grade A milk production traced troubles on 130 farms to some minor slip in sterilizing equipment; and a better understanding of the principles involved in low-bacteria milk now enables most of the farmers in the area to deliver milk with less than 10,000 count. A retail milk marketing study formed the basis of the development which has resulted in the state milk control board.

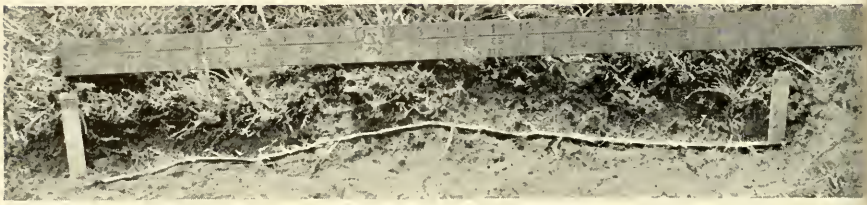
9. Land utilization study, which has brought out in bold relief the meagerness of farm production in certain back areas and has provided basic data for formulating a definite policy.

10. A study of types of farming, showing the extent and type of farming for each commercial farm in the state — the most complete picture ever drawn of New Hampshire's agriculture.



A comparison of man hours on barn chores per 1,000 pounds of milk on 38 farms

RESEARCH GOES INTO THE FOREST

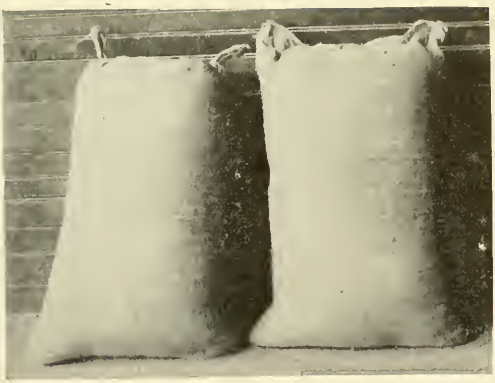


(ABOVE) *This white pine root grew 26 inches in a year. Studies of root growth are giving important information on pine habits*

(LEFT) *Weeding pine stands of gray birch has now become common practice in the farm woodlots of the state. Careful research on growth of various tree species is responsible for the project*

(BELOW) *Experimental plots in thinning white pine were started in 1913*

A STEADY bulwark against fraud is the annual inspection service of feeding stuffs, fertilizers and seeds, conducted at the Experiment Station for the State Department of Agriculture. The New Hampshire farmer purchases about $8,000,000 worth of feed and fertilizer a year. No big commercial company would think of buying this quantity of materials without maintaining a laboratory to check carefully the quality of his purchases; and the chemical analyses have made it possible for the State Department to insist upon an honest declaration of contents. In the last ten years the percentage of feed samples found deficient in protein has decreased from 24 to 5.

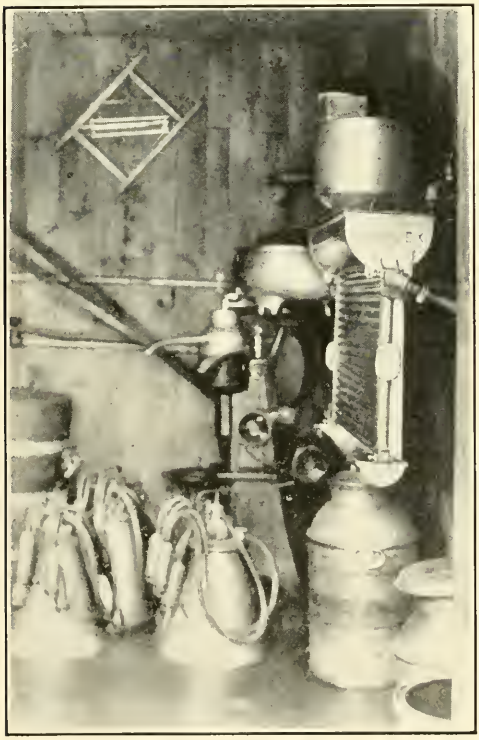


LONG-TIME breeding experiments have thrown much light on the Mendelian characteristics of sheep and made new combinations feasible. The New Hampshire Station was selected to carry on the investigations conducted for 35 years by Alexander Graham Bell in the development of multi-nippled sheep. The two lambs shown below were recently sent to England for breeding purposes.

LIGHTING UP A STATE

NEW HAMPSHIRE leads the country in the percentage of its farm homes electrified. This fact is not an accident. It results from the recognition by power companies of the value of the farm load and their willingness to meet organized farmers half-way in the extension of lines. Behind the whole movement rests the research into use of electricity on the farm, conducted by the Experiment Station in 1925–30. The New Hampshire Station was selected to represent the New England area by the National Committee on the Relation of Electricity to Agriculture.

Milk cooling proved one of the important uses of electricity. Total consumption on the experimental farms reached an ultimate average of 428 kilowatt hours a month



AVENUES OF INFORMATION

INFORMATION service is issued from the New Hampshire Station through a definite system of:

Extension workers, officed in each county of the state.

Bulletins, 346 of which have been issued, with a total circulation of 3,444,000 copies.

Correspondence. The daily mail brings queries of almost every conceivable nature.

Newspaper articles, sent regularly to daily and weekly papers of the state, as well as to agricultural journals.

Addresses by members of the staff before Granges, Farmers' institutes and Farm Bureau meetings, and now including a radio broadcasting service.

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